REITZ

A Determination of the Overhead Charges in the Shop Laboratories

Mechanical Engineering

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A DETERMINATION OF THE OVERHEAD CHARGES IN THE SHOP LABORATORIES

BY

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

Walter Richard Reitz

ENTITLED A Determination of the Overhead Charges in the Shop Laboratories

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE

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Introduction

The processes of manufacture fall into four natural divisions, namely: purchase, production, selling, and administration. The total expense involved in these processes fixes the cost of manufacture and disposal of the product. Profit is the amount received in addition to this sum.

Each of these divisions is composed of charges of a different nature, which may be roughly classified as "direct" and "indirect", or in shop parlance, "productive", and "non-productive" according to the character of the element entering into the various charges. Expenditures for materials and shop labor, obviously, are direct charges, while supervision, taxes, etc., are indirect charges. General manufacturing expense, therefore, resolves itself into a proposition of three parts,- labor, materials, and general expense, or as commonly designated, overhead charges. The first embraces all outlay for labor engaged in manufacturing the product; the second, all expense for materials used in manufacturing; and the third, those expenditures not included in labor and materials, but which are necessary in the conduct of the business.

For purposes of demonstrating the principles of management, the Shop Laboratories are considered as a manufacturing plant with four departments. The cost of production is of the same importance as in a regular manufacturing establishment, not for

commercial reasons, but for demonstration purposes. It becomes necessary in this plan to record all direct and indirect expenses, and it is the purpose of this study to ascertain the third principal item of expenditure, previously mentioned, namely, overhead charges. The subject has been approached in a practical way for practical uses.

GENERAL OUTLINE

"Overhead Charge" may be defined as the total cost of production of an article, exclusive of the cost of direct labor and material. When a manufacturer puts a product on the market, in competition with other manufacturer's products, he must make his price as low as possible, and still allow himself a legitimate profit. But how is this price to be determined? He can determine the actual labor and material cost for each article, but these are not the only items which enter into the cost of producing that article. He has to pay office help, supervision, rent, power, taxes, etc., which do not enter directly into the cost of each article, but as items of expense, must be taken into consideration, and prorated over actual production costs, according to the total expenditure for this purpose.

The two items of labor and material, commonly called direct charges, usually form the basis for determining the overhead charges, as they constitute the basic forms of expense, and are known with some degree of accuracy.

The items which enter into the overhead charges vary with different shops and with different localities. A few of the more important ones are found in every shop, while many of minor importance are governed by operating conditions. Our shop laboratories at the University may be taken as a fair example of general shops and the items entering into the overhead charges include practically everything that can be considered as such.

Following are the items that must first be determined in attempting to ascertain the overhead charges. The values of these items do not enter directly into the overhead charges, but they

must be determined, so that other items dependent upon them can also be determined. The items are:

Real Estate,
Buildings,
Equipment,
Stock Materials.

The following items, called fixedcharges, are actual overhead charges. They are figured on the basis of the values of the preceding items. They are:

Depreciation,
Interest on Investment,
Taxes,
Insurance.

These items enter directly into the cost of production as overhead charges. The item of depreciation is one that must be figured from experience. Certain machines give good service for many years before they are ready for the scrap pile. Other machines must be disposed of while comparatively new, because some later machine with modern improvements renders it unprofitable to operate the old machine. There are other things entering into depreciation, such as breakage and wear and tear of service, all of which tend to decrease the life and value of a plant.

Very little need be said as to the necessity of including the other three items, namely, "Interest on Investment", "Taxes" and "Insurance", in the overhead charges. They are positive quantities which can easily be determined, and as actual cost entering into production, they must necessarily be reckoned in the overhead charges.

The next and last series of charges represents what may be called "Operating Costs". Here again it is plain that these values represent actual money paid out, and therefore, as items of expense, must be considered as general production costs. These items are:

Supervision,
Indirect Labor,
Power,
Light,
Heat.

Under the item "Supervision" may be included manager's salary, foreman's salary, etc. "Indirect Labor" may be divided into two classes, clerical and manual. As given here, these two classes are grouped under the one heading.

Power, Light, and Heat, are items of indirect expense which are purchased from outside companies or furnished by the local power plant. In either case, the cost of this service is determined from monthly cost statements, which allow an easy, but accurate, method of distributing these charges over the products manufactured in the shops.

In the preceding paragraphs, I have outlined what overhead charges are, what they include, and, in a general way, how the total charge may be determined. I shall now take up the problem of applying this general overhead charge to the articles of production, so proportioning it that each article will bear its proper share of the burden.

There are five principal methods of distributing overhead charges over direct manufacturing costs, as follows:

By Material,
By Percentage of Wages,
By Man Hours,
By Machine Rates,
By Production Factors.

All of these methods have certain merits which make them applicable to various industries. The first is not in general use, but is confined to those industries where material is the largest item of expense. The second is most generally used, and gives fairly good, but not accurate, results.

In this system, the overhead charges are apportioned to each article in proportion to the value of the labor expended in producing that article. The system, as it is operated, is always one month behind in the application of the overhead charges. Let us first assume that the overhead charges for a certain month are known, and the value of the labor for the previous month is also known. Using this labor value as a basis, the overhead charge per unit value of labor is calculated, and is used as the basis for the present month's overhead charge. This method is logical and will give fair results, providing the value of the labor and product remains practically constant. If, however, there is a wide variation in the nature of products, it is obvious that the labor charges will vary per unit and cause an unequal division of the overhead expense. Thus where uniform conditions of manufacture exist, this method may work satisfactorily, but it is not adaptable to manufacturing where varying conditions prevail. A concrete example will illustrate this.

We will assume that the overhead charges for a certain month amount to $1,000.00 and that the value of labor for the previous month was $1,820.00. Using these items as a basis for the present month's calculations, we find that for each dollar of labor spent in producing an article, we must add fifty-five cents for overhead charges. At first sight this appears to be a good method and, as stated before, it will give good results, if the labor and indirect charge do not vary greatly from month to month. But if the usual ratio between the two changes in the following month, the overhead expense will not be correctly distributed over the basis of the cost of labor. This is a condition not desired. The overhead charges per month vary independently of the labor expense, and the method breaks down when a change occurs in the original conditions on which the overhead ratio was determined, as illustrated by continuing the preceding example. We have our overhead charge of $1,000.00 per month and our labor charge of $1,820.00 per month, making a charge of fifty-five cents per dollar's worth of labor. Suppose that times become dull and business is slack the present month, and that the labor expense drops to $1,200.00. The overhead charge on each dollar spent for labor will be eighty-three cents as against fifty-five cents of the previous month. Yet the overhead charge will continue as fifty-five cents or a little over fifty per cent less than it should be.

There are other inequalities in this method, which will not be touched upon, but it is quite evident that the manufacturer who uses such a method will not have a correct distribution of expense, and business obtained on conclusions based on

production costs may be unremunerative.

The foregoing example is simply one illustration of the difficulties encountered in attempting to apply the most common method now in use for the determination of the overhead charges. In view of this fact, the writer believes that there is room for improvement in the methods now employed and, therefore, suggests that the third method referred to, namely, "By Man Hours" will, with certain modifications, prove the most satisfactory one for the conditions of manufacture in the shop laboratories. In the method known as the "man hour" plan, distribution of overhead expense is made on the basis of time worked, instead of money paid for the labor spent on the job. The error of the first method in loading improper charges on operations performed by labor at varying rates of pay is avoided by the other. The "man hour" method, however, as generally understood and applied is open to some of the objections of other methods, so it is proposed to modify it by extending the time unit from the hours actually worked to that available for work. A more expressive designation of this method is the standard work-hour plan.

The basis for determining the overhead charge in this system is the unit of time worked, or the man hour. The total overhead cost is first determined for some period of time, and from that, the cost per man hour is calculated, that is for 24 hours per day, and 365 days per year. Knowing the charge per standard work hour, we can at once apportion the overhead charges on the articles of production over the hours actually worked. The overhead charge per hour might be used directly, but it is more convenient

to apportion this charge over the production in a week's time, so that the irregularities of a day's work will not be so important. Therefore, the total overhead charge for the week is 168 times the hourly charge, and if one man works on a piece for a week, the overhead charge on that piece is 168 times the hourly charge. Now, if more than one man is working on a second article, the overhead charge per article varies inversely as the total number of hours worked by all the workmen. An example will serve to make the method clearer. Let us assume that we have determined the total overhead charge for a certain period of time, and that it amounts to two dollars per hour. This is equivalent to $336.00 per week. Now if one man works for 60 hours that week on a piece, the total overhead charge on that piece is $336.00 or $5.60 per hour worked. If two men work for 60 hours each, in one week, on two pieces, the total overhead charge being $336.00 the charge per hour worked per piece will be one half of the previous amount, or $2.80. In a similar manner, if ten men work on ten pieces, the overhead charge per piece is $0.56 per hour worked. It is plainly seen that with this method, articles of manufacture will receive their share of the overhead burden on the basis of the time each is in the shop, independent of the labor costs.

To carry our example still further, let us assume that our overhead charge is $2.00 per hour, or $336.00 per week, and that 30 men work 55 hours each that week, and produce 100 similar articles. The overhead charge per article would then be

$$\frac{2 \times 168 \times \frac{30 \times 55}{100}}{30 \times 55} = \$3.36$$

If, under the same overhead expense, 30 men work 55 hours each and produce three articles, one taking 825, the second 550, and the last 275 hours each the overhead charge per article would then be:

$$(1) \qquad \frac{2 \times 168 \times 825}{1650} = \$168.00$$

$$(2) \qquad \frac{2 \times 168 \times 550}{1650} = \$112.00$$

$$(3) \qquad \frac{2 \times 168 \times 275}{1650} = \$56.00$$

Thus we can derive a formula for determining the overhead charge per article as follows:

Let C = total overhead charge per hour,
" N = the number of hours in the period considered,
" M = the total man hours worked during that period by all men,
" H = the man hours spent on the article,

Then the overhead charge S, per article, is given by the formula

$$S = \frac{C \times N \times H}{M}$$

For any definite period, with standard working conditions, the value $\frac{C \times N}{M}$ becomes a constant and the formula reduces to $S = KH$.

Following is a list of the steps followed in calculating the overhead charge per article:

(1) Determine the total overhead charge for the period considered.
(2) Determine the overhead charge per hour for the period
(3) Determine the total number of man hours worked during the period
(4) Determine the number of man hours spent on each article produced in that period.

(5) Apply the formula and determine the overhead charge per article.

The advantages of the method, which may be pointed out, are:

(1) Maximum degree of flexibility in distributing overhead charges to manufactured articles.

(2) Simplicity of the "percentage-on wages" method, but without the inaccuracies of that plan.

(3) Distribution of expense on the basis of hours actually worked, giving an easy, but accurate, method of calculating and assigning overhead charges.

(4) Provides for establishment of overhead costs per standard shop hour, essential information for economical production.

APPLICATION OF THE METHOD TO THE UNIVERSITY SHOP LABORATORIES.

The system described in the foregoing pages has been used in this thesis for the determination of the overhead charges in the University Shop Laboratories. This being the first attempt to ascertain the overhead charges here, the writer has had to make a thorough investigation of all the elements entering into the subject and develop a method particularly adapted to local conditions. A few departures from usual commercial practice will be noted. For instance, no mention is made of clerical forces, nor advertising expense as neither of these are factors in the Shop Laboratories. These two items are generally large and important, and as they can be readily determined in a commercial plant, it would be a simple matter to add them to the total overhead charges from those items given in this thesis. For this reason, the overhead charges here determined are rather low, but they serve to illustrate the method involved and that is the purpose of this study.

The writer has chosen June 30th, 1913 as the date of this determination, and the overhead charges have been calculated for the year previous. From this total they were reduced to the hourly basis so that the result obtained is the total overhead cost per hour of time during the period. This is the value "C" in the equation derived. The other quantities, N, H, and M vary according to the length of the period in which the overhead charge is apportioned to the articles of production.

The overhead charges have been figured for each of four departments, namely, Machine, Pattern, Forge and Foundry.

The items included in the overhead charges are shown in tabular form, together with their actual and hourly values, in the following pages. They are:- Depreciation, Interest on Investment, Taxes, Insurance, Supervision, Labor, Power, Light and Heat. Depreciation has been figured at five per cent of the present value. Interest on investment has been assumed at five per cent. Taxes and Insurance have been figured from the present rates in this locality which are as follows:- Tax rate - $5.81 per $100.00 of the assessed valuation. The assessed valuation is one-fifth of the actual valuation.

The insurance rates vary for the different departments. They are the flat rates based on 90% co-insurance. They are as follows:-

	Rate per $100.00 on	
	Building	Equipment
Machine Department	$1.25	$1.42
Pattern "	1.86	2.12
Forge "	1.51	1.73
Foundry "	1.19	1.36

Under Supervision is included the salary of the director of the shop laboratories, proportioned equally among the four departments, and the salaries of the instructors. These will correspond to the salaries of the executive staff in industrial organizations. Indirect Labor includes the salaries of stock room attendants, janitor service and repair men. Power, Light, and Heat are direct expenses, which are as follows:

POWER.

	Kilowatt hours per year
Machine Department	28,000
Pattern "	20,000
Forge "	6,250
Foundry "	4,320

LIGHT.

Machine Department	1,500
Pattern "	900
Forge "	300
Foundry "	400

The above power has been figured at a rate of ten cents per kilowatt hour.

By summing up the partial hourly charge for each item, we obtain the value "C" for each department, as follows:

Machine Department	$1.415 per hour
Pattern "	1.254 " "
Forge "	.637 " "
Foundry "	.725 " "

As might be expected, the overhead charges per standard hour on the Machine and Pattern departments are considerably greater than those on the Forge and Foundry. This is due to the increased cost of equipment, and consequently, increased depreciation, interest on investment, taxes, insurance, power, and light. A list of the equipment of each shop is given on succeeding pages. This is an item which consumed considerable time in the preparation of this thesis.

Inventory values of property and the various items of general expense which constitute the overhead charges on manufacturing processes in the Shop Laboratories are tabulated in the following pages.

VALUE OF PERMANENT PROPERTY AT END OF FISCAL YEAR JUNE 30-1913

Real Estate		
Machine Department		$ 6,500.00
Pattern	"	10,000.00
Forge	"	3,500.00
Foundry	"	5,000.00
Buildings		
Machine Department		12,000.00
Pattern	"	22,000.00
Forge	"	8,000.00
Foundry	"	15,000.00
Equipment		
Machine Department		20,910.50
Pattern	"	8,423.60
Forge	"	4,331.00
Foundry	"	3,024.25
Stock Materials		
Machine Department		1,484.00
Pattern	"	1,034.00
Forge	"	425.00
Foundry	"	1,856.00
TOTAL VALUE OF PERMANENT PROPERTY		
Machine Department		$40,894.50
Pattern	"	41,457.60
Forge	"	16,256.00
Foundry	"	24,880.25
		$123,488.35

FIXED CHARGES FOR FISCAL YEAR ENDING JUNE 30-1913

	Per Year	Per Hour
Depreciation		
Machine Department	$1,720.00	$0.197
Pattern "	1,550.00	0.177
Forge "	640.00	0.073
Foundry "	995.00	0.113
Interest on Investment		
Machine Department	2,045.00	0.234
Pattern "	2,070.00	0.236
Forge "	825.00	0.094
Foundry "	1,245.00	0.142
Taxes		
Machine Department	475.00	0.054
Pattern "	482.00	0.055
Forge "	189.00	0.022
Foundry "	289.00	0.033
Insurance		
Machine Department	423.00	0.048
Pattern "	548.00	0.063
Forge "	184.00	0.021
Foundry "	221.00	0.025
TOTAL FIXED CHARGES		
Machine Department	$4,663.00	$0.533
Pattern "	4,650.00	0.531
Forge "	1,838.00	0.210
Foundry "	2,750.00	0.313
	$13,901.00	$1.587

OPERATING COSTS FOR FISCAL YEAR ENDING JUNE 30-1913

	Per Year	Per Hour.
Supervision		
Machine Department	$2,975.00	$0.339
Pattern "	3,275.00	0.374
Forge "	2,725.00	0.311
Foundry "	2,825.00	0.319
Labor Indirect		
Machine Department	1,690.00	0.193
Pattern "	850.00	0.097
Forge "	300.00	0.034
Foundry "	300.00	0.034
Power		
Machine Department	2,800.00	0.320
Pattern "	2,000.00	0.228
Forge "	625.00	0.071
Foundry "	430.00	0.049
Light		
Machine Department	150.00	0.017
Pattern "	90.00	0.010
Forge "	30.00	0.003
Foundry "	40.00	0.005
Heat		
Machine Department	110.00	0.013
Pattern "	120.00	0.014
Forge "	70.00	0.008
Foundry "	40.00	0.005

TOTAL OPERATING COSTS

Machine Department	$7,725.00	$0.882
Pattern "	6,335.00	0.723
Forge "	3,750.00	0.427
Foundry "	3,635.00	0.412
	$21,445.00	$2.444

INVENTORY SHEETS OF THE

EQUIPMENT OF THE DEPARTMENTS OF THE SHOP LABORATORIES

MACHINE DEPARTMENT - MACHINES

1	Vertical Boring Mill	$ 760.00
1	Horizontal " "	800.00
1	Traveling Crane	365.00
1	Lodge & Davis Drill Press	50.00
1	Central " "	70.00
1	W. F. & J. Barnes Drill Press	70.00
1	Davis Egan " "	150.00
1	Bickford Radial " "	857.00
1	Barnes Emery Grinder	68.00
1	U. of I. " "	45.00
1	B. & S. Universal Grinder	400.00
1	B. & S. Cutter "	170.00
1	Grisholt "	350.00
1	LaSalle Surface "	60.00
1	Twist Drill "	73.00

LATHES

3	Bradford	675.00
6	Flather	1,130.00
1	Gould Eberhardt	175.00
1	Hendy	300.00
1	LeBlond	175.00
3	Pratt & Whitney	1,265.00
1	Putnam & Sons	500.00
1	Prentice	325.00
4	Reed	920.00
4	Von Wyck	1,000.00

1	Whitcomb Blaisdell	$ 282.00
1	Cincinnati Milling Machine	1,017.00
1	B. & S. " "	325.00
1	Brainard " "	250.00
1	Gray Planer	500.00
2	Gould Eberhardt Shapers	320.00

MISCELLANEOUS MACHINES

1	Acme Bolt Cutter	210.00
1	Peerless Belt Lacer	60.00
1	B. & S. Gear Cutter	875.00
1	Grind Stone & Stand	40.00
1	Mandrel Press	12.00
1	Garton Engraving Machine	315.00
1	Key Seater	60.00
1	Cleveland Screw Machine	1,100.00

TOOL ROOM

8	Augers	3.00
55	Calipers	107.00
18	Micrometer Calipers	85.00
1	Rotary Magnetic Chuck	39.00
26	Lathe Chucks	780.00
26	Clamps	30.60
30	Angular Cutters	64.00
4	Sets Bevel Gear Cutters	79.00
15	Sets Spur " "	576.00
31	Milling Cutters	75.00

18	Cold Chisels	$ 10.00
3	Counter Bores	1.00
7	Counter Sinks	3.00
1	Black Diamond	20.00
46	Dies	68.50
7	Die Stocks	58.00
9	Dividers	12.00
101	Dogs #1 to #14	51.90
1	Breast Drill	4.00
1	Electric Drill	31.00
3	Ratchet Drills	20.00
28	Center Drills	2.50
74	Straight Shank Drills 1/4" to 1/2"	13.00
396	" " " #1 to #48	22.40
217	Taper Shank " 1/4" to 2"	201.10
3	Emery Wheel Dressers	5.00
5	Sets Figures Stamps	8.80
36	Files	8.25
2	Sets Caliper Gauges	130.00
12	Center Gauges	3.30
1	Surface Gauge	2.70
1	Drill Gauge	1.60
1	Electric Grinder	36.00
83	Tool Holders	103.00
18	Drill Holders	18.00
3	Hack Saws	2.25
8	Hammers	3.60

94	Lathe Tools	$ 36.00
2	Sets Letters Stamps	5.50
1	Level	1.50
176	Mandrels 1/4" to 2"	192.00
44	End Mills	54.60
44	Oil Cans	9.20
9	Pairs Pliers	6.00
8	Planer Jacks	7.00
1	Plane	2.00
6	Surface Plates	47.00
12	Center Punches	2.70
12	Drill Drift Punches	2.00
47	Hand Reamers 1/4" to 2"	128.40
13	Taper Reamers #0 to #10	26.00
36	Machine Reamers	98.00
20	Shell Reamers	120.00
41	Rules	28.00
14	Slit Saws	9.20
23	Screw Drivers	14.50
20	Drill Sleeves	18.00
2	Pairs Snips	4.00
2	Speed Counters	2.70
20	Squares	54.00
152	Hand Taps	160.00
73	Machine Taps 1/4" to 1 1/4"	35.00
19	Pipe Taps	17.40
2	Tape Measures	11.40

1	Stop Watch	$ 6.00
97	Straight Wrenches	11.00
34	Monkey Wrenches	20.00
12	Tap Wrenches	8.00
3	Pipe Wrenches	11.00

MISCELLANEOUS EQUIPMENT

2074	Feet Belting	332.90
1	Chain Hoist	9.00
1	25 H. P. Motor	280.00
1	Time Clock	98.00
22	Vises	244.00
	Total Value of Equipment	$20,910.50

STOCK MATERIALS

Bolts, Nuts, Screws, Washers, etc.	$ 245.00
Emery Wheels	10.00
" Cloth	15.00
Finished Engine Stock	11.00
" " Castings	220.00
Unfinished " "	53.00
Jigs	367.00
Steel Shelves	338.00
Office Furniture	225.00
Total Value of Stock Materials	$1,484.00

PATTERN DEPARTMENT - MACHINES

1	Emery Wheel & Stand	$ 55.00
2	Centrifugal Fans	36.00
1	Knife Grinder	85.00
1	Grind Stone	20.00
10	Lathes	470.00
8	"	320.00
1	"	108.00
1	"	206.00
2	7.5 H.P. Motors	225.00
1	Smooth Planer	200.00
1	Band Saw Machine	130.00
1	" " "	285.00
1	Combination Saw	358.00
1	Speed Counter	6.00
3	Fox Trimmers	67.50

TOOLS

2	Sets Forstner Bits 1/4" to 1 1/4"	25.00
512	Spur Auger Bits 1/4" to 15/16"	76.00
12	Bit Braces	16.20
27	Bench Brushes	10.80
36	Glue Brushes	9.00
52	Adjustable Calipers	58.00
3	Pairs Caliper & Trammel Points	2.40
1106	Wood Chisels 1/8" to 2"	143.90
12	Crank Chisels 1/4" to 2"	20.00

150	Wooden Clamps	$ 131.00
24	Countersinks	4.80
260	Dividers	391.00
12	Half Round Files	9.00
260	Bevel Gages	312.00
260	Scratch Gages	130.00
74	Gimlets	7.00
444	Gouges 1/4" to 2"	150.80
72	Special Gouges	35.00
260	Claw Hammers	117.00
6	Draw Knives	6.00
33	Scarfing Knives	13.00
1	Set Letters & Numbers	4.50
12	Oil Stones	21.00
628	Planes	1,004.00
28	Special Planes	30.00
36	Center Punches	6.00
36	24 inch Rules	36.00
260	Back Saws	350.00
14	Large Saws	19.00
1	Buck Saw	3.00
6	Keyhole Saws	1.60
36	Screw Drivers	28.00
138	Skews	86.60
9	Spoke Shaves	4.00
275	Squares	734.50
3	Monkey Wrenches	2.80

MISCELLANEOUS

268	Feet Belting	$ 103.20
27	Benches	1,620.00
24	Cabinets	120.00
1	Level	1.00
1	Meter Box	5.00
2	Saw Sets	4.00
	Total Value of Equipment	$8,423.60

STOCK MATERIALS

	Lumber	640.00
4	Kegs Nails	24.00
	Pulleys & Hangers	100.00
432	Feet Band Saws	45.00
	Office Furniture	225.00
	Total Value of Stock Materials	$1,034.00

FORGE DEPARTMENT

33	Anvils	$ 363.00
1	Emery Wheel and stand	25.00
6	Flatters	1.00
12	Buffalo Forges	216.00
21	U. of I. Forges	300.00
12	Top & Bottom Fullers	6.00
1	Electric Furnace	420.00
2	Gas Furnaces	167.00
33	Hammers	20.00
1	Belt Hammer	300.00
1	Steam Hammer	770.00
1	Hardening Bath	20.00
33	Hardies	10.00
2	Motor & Blower Sets	641.00
1	Shore Pyroscope	60.00
1	Hoskins Pyrometer	45.00
1	Cochran Cold Saw	200.00
1	Shore Seleroscope	103.00
1	Power Shears	524.00
3	Sledges	10.00
12	Top & Bottom Swages	6.00
198	Pairs of Tongs	118.00
1	Stop Watch	6.00
	Total Value of Equipment	$4,331.00

STOCK MATERIALS

Office Furniture	$ 225.00
Bar Steel	200.00
Total Value of Stock Materials	$425.00

FOUNDRY DEPARTMENT

12	Bellows	$ 16.20
16	Molding Brushes	5.00
1	Buckeye Oil Burner	89.00
1	Oil Burner for Core Oven	6.50
12	Cold Chisels	6.75
1	Casting Cleaner	70.00
1	Core Car & Track	50.00
1	Core Machine	40.00
1	Core Oven- Brick	200.00
1	Core Oven- Portable	80.00
1	Tool Cupboard	35.00
1	5 Ton Crane	750.00
1	#0 Whiting Cupola	80.00
1	#1 " "	175.00
1	Emery Wheel & Stand	50.00
20	Flat Files	13.00
193	Flasks	225.00
1	Coke Fork	2.00
1	Brass Furnace	80.00
2	Pairs Goggles	1.00
4	Chisel Hammers	2.50
1	Hack Saw Handle	1.00
1	1/4 Ton Chain Hoist	10.00
9	Bull Ladles & Shanks	19.00
2	Cup Ladles	63.00

4	Hand Ladles & Shanks	$ 4.00
8	Hand Ladle Bowls	16.00
2	Ladle Bails	50.00
1	Electric Lift	200.00
1	24 inch Level	1.00
4	Molding Machines	200.00
10	Rubber Mallets	4.00
2	Motor and Blower Sets	253.00
4	Oil Cans	1.00
2	Pairs Pliers	1.00
1	Air Riddle	50.00
2	Bench Rammers	2.00
12	Floor Rammers	4.00
1	Saw	1.50
42	Sieves	42.00
20	Shovels	25.00
28	Slicks	16.00
1	Platform Scales	10.00
2	Sledges	3.60
2	Pairs Crucible Tongs	2.00
30	Trowels	23.00
1	Coal Wagon	44.00
2	Monkey Wrenches	1.20
	Total Value of Equipment	$3,024.25

STOCK MATERIALS

Coke	50.00

Pig Iron	$ 300.00
Scrap Iron	175.00
Coal Oil	6.00
Patterns	1,000.00
Sand	100.00
Office Furniture	225.00
Total Value of Stock Materials	$1,856.00